ICAR - CM2T
Ingénierie Matière

e-Newsletter N°42 – Decembre 2020

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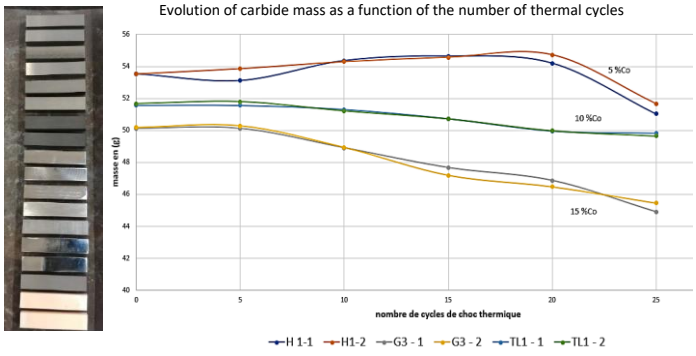
MATREX : MATerials for Resistance in EXtreme conditions …

ICAR - CM2T will materialize the merger in 2020 through a 3-year collaborative research program entitled MATREX, the acronym for materials in extreme conditions. **Born in the midst of the fusion of the two structures, this center of excellence (ICAR - CM2T, CRITT MDTS, Cerfav and Holo 3) aims to strengthen skills in optimizing the service life of materials highly stressed by temperature, corrosion, wear, mechanical. The main areas targeted are forging, glassmaking, furnaces and boilers.** The larger service offering and the broadening of skills now allow us to combine the study of metallic and ceramic materials.

The new solutions for refractory materials for glass tools were checked on steels, carbides, graphites and ceramics. To check this, thermal shock resistance tests were carried out on these different materials.



The thermal shock test (500 and 700°C and water quenching) makes it possible to verify that the materials or pair of materials / coating retain their property integrity. At each cycle we carry out optical examinations, weighings, dimensional checks and resonance tests (Grindo-Sonic process).

We tested several types of graphite, the Ferro-Ni laser hardfacing alloy, stainless steel, H11 tool steel, molybdenum alloy GL cast iron, tungsten carbides and ceramic.

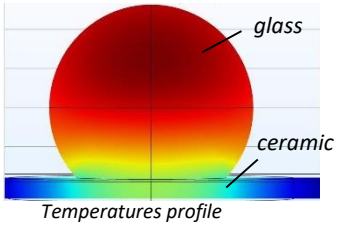
Visually, all of these alloys held up relatively well at 500°C for 5 cycles.
Subsequently, a slight oxidation appeared on most of the materials apart from Ferro-nickel. None of these materials have suffered any fracture or cracking.

At 700°C, none of the materials failed but after 15 cycles some materials became destabilised.

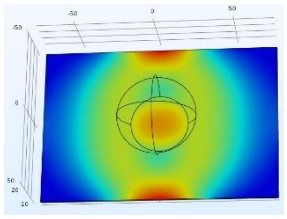
After 25 cycles, only the carbides suffer major damage, the surface layers oxidize to form WO_3 oxides and delaminate. At 700°C, the most stable material is ceramic, followed to a lesser extent by stainless steel, tool steel, and hardened alloy Fe55Ni.

These results allow us to understand how these materials will be able to behave as tools during glass pressing.

In order to put into practice the preliminary thermal shock test studies, a research axis by finite element simulation is opened with the aim of predetermining the optimum parameters in the implementation of these materials, and more particularly in the application of glass molds.



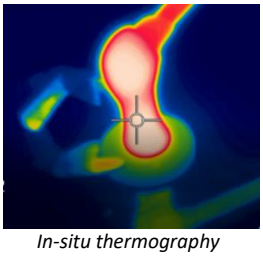
Temperatures profile


Strains profile

The selected models were improved by a series of tests carried out with Cerfav (www.cerfav.fr/innovation) in the premises of Vannes-Le-Châtel. The results obtained during these tests raised many questions and made it possible to greatly advance the MATREX project.

The equipment set up by ICAR-CM2T (high temperature infrared camera, resonance frequency measuring device, etc.) made it possible to carry out a large number of in-situ measurements.


A parison on a sample


In-situ thermography

New materials already shaped in the frame of the pilot mold were also able to be tested during this day of collaboration. The test on the additive bonded sand impression highlighted some necessary constraints to be added when designing moulds in this material and by this method.

The addition of a coating to reinforce and functionalize known existing surfaces is also studied, in particular through tests on deposits obtained by Cold Spray. There are many applications, whether in tooling, but also in the fields of aeronautics, nuclear power or medical prostheses.

Partners : CRITT Centre Régional d'Innovation et de Transfert de Technologie · Cerfav CRT - VERRE · HOLO3 métrologie optique

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ICAR-CM2T team wishes you a Happy Christmas 2020 and a Happy New Year 2021…

Take care of yourself

Bibliography:

This selection of publications comes from Technical Survey made by the SFC (Société Française de Céramique) Documentation department. For more information on these documents of Scientific, Technical and Competitor Intelligence Survey: Monthly Survey reports, target specific Surveys, access to "CeramBase" Survey database, contact SFC to the address: **soc.fr.ceram@ceramique.fr**

SFC

- NAGESH A.K., ILANGO N.K., ALEX A., AND -AL.

A novel approach to lightweight alumina-carbon refractories for flow control of molten steel

Journal of the American Ceramic Society, vol. 103, n°08, 09/2020, pp. 4713-4724, 12 fig., 3 tab., bibliographie (34 réf.), ANG.

A lightweight carbon-alumina refractory material with microporous corundum aggregates instead of dense aggregates is prepared. A comparative analysis with traditional dense refractories is carried out: the microstructures and the mechanical properties are compared. Microporous aggregates exhibit a better aggregate / matrix binding interface. Crack propagation at the aggregate / matrix interface is suppressed.

Key words: ALUMINA. CARBON. AGGREGATE. MICROSTRUCTURE. POROSITY. CRACK. INTERFACE

- TAKEUCHI S., TAIRA H.

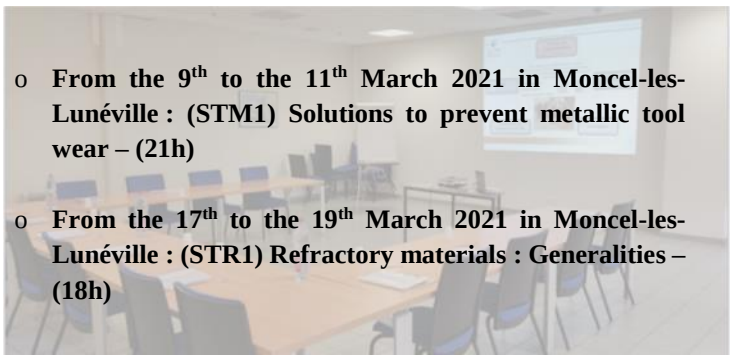
Method and problem for measuring thermal conductivity of refractories

Journal of the Technical Association of Refractories, Japan, Vol. 40, n°3, 09/2020, pp. 176-180, 7 fig., 1 tab., bibliographie (12 réf.), ANG.

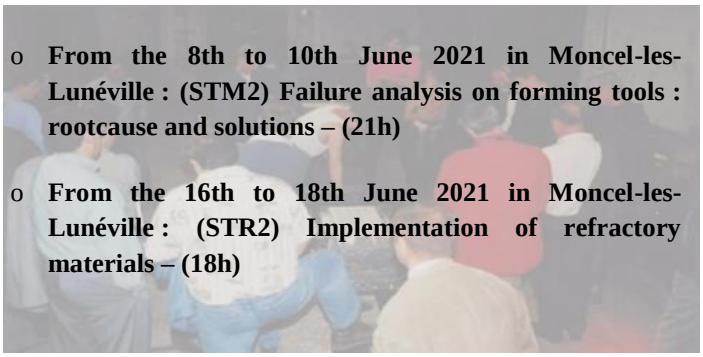
This article lists the difficulties encountered when measuring the thermal conductivity of refractory materials depending on the methods used. The selection of a precise method is approached based on the characteristics of the sample to be analyzed.

Key words: THERMAL CONDUCTIVITY. REFRACTORY. ANALYSIS.

TRAININGS TO COME (IN FRENCH ONLY)



- **From the 9th to the 11th March 2021 in Moncel-les-Lunéville : (STM1) Solutions to prevent metallic tool wear – (21h)**
- **From the 17th to the 19th March 2021 in Moncel-les-Lunéville : (STR1) Refractory materials : Generalities – (18h)**



- **From the 8th to 10th June 2021 in Moncel-les-Lunéville : (STM2) Failure analysis on forming tools : rootcause and solutions – (21h)**
- **From the 16th to 18th June 2021 in Moncel-les-Lunéville : (STR2) Implementation of refractory materials – (18h)**

And still the possibility to perform intra-company trainings throughout the year on metallic and refractory materials…

For more information…CONTACT US…

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